REMARKS

Claims 1-23 and 46-51 are all the claims presently pending in the application. New claims 46-51 have been added to more particularly define the invention. Claims 1-23 stand rejected on prior art grounds. Claims 4-7 stand rejected upon informalities (e.g., 35 U.S.C. § 112, second paragraph). Reconsideration is respectfully requested.

Claims 1, 2, 4, 5, 8-11, and 15-23 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Houtz (U.S. Patent No. 6,358,068). Claims 3, 6, and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Houtz in view of Beroz et al. (U.S. Patent No. 6,329,605). Claims 12-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Houtz in view of Prior Art Figure 1D.

These rejections are respectfully traversed in view of the following discussion.

It is noted that the amendments are made only to more completely define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by claim 1, is directed to an electric terminal for an electronic device.

The electric terminal includes an external electrode, a lead member disposed on an internal electrode of the electronic device, at least a portion of the lead member being a conductor electrically connecting the external electrode and the internal electrode, and a support member

disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. (Page 5, lines 9-17; Page 7, line 1-25; Page 10, line 1-11; and Figures 3-5).

Conventional electronic terminals have "a solder ball formed on an electronic device is mounted on a pad of a printed circuit board, and is melted thereon for bonding," without any separate support member. However, the conventional structure tends to form cracks in the solder ball during the heat cycle test, and thus reduces the reliability of the connection. (See Page 1, line 15 - Page 2, line 12; and Figures 1 and 2).

An aspect of the invention includes a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member, which has a mechanical supporting function "to prevent an excessive deformation of the lead member during an electrical test step, ..., and thus prevents the solder ball from being applied with an excessive, local stress concentration," thereby reducing, efficiently, cracking in the solder ball. (Page 7, lines 15-25).

As a result, this inventive structure improves "the reliability of the electric connection against damage by the thermal stress and the mechanical strength necessary for handling and testing the electronic device." (See Page 5, lines 18-25; and Page 8, lines 1-9).

II. 35 U.S.C. § 112, Second Paragraph, Rejection regarding Claims 4-7

Applicant has amended the claims in a manner believed fully responsive to all points raised. In particular, Applicant has amended claim 4 to recite "the external electrode comprises an external terminal, and the external terminal includes a solder ball." (See Specification, Page 7, lines 1-6). In view of the foregoing, the Examiner is respectfully requested to withdraw this rejection.

III. THE PRIOR ART REJECTIONS

A. The § 102(b) Rejection Based on Houtz

Applicant submits that there are elements of the claimed invention which are neither taught nor suggested by Houtz ("Houtz"). Houtz fails to teach or suggest, including a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. (Page 5, lines 9-17; Page 7, line 1-25; Page 10, line 1-11; and Figures 3-5).

In contrast, Figures 1, 2, and 13 of Houtz merely disclose electrical connectors capable of being mounted on circuit substrates by ball grid array techniques. The electrical connector includes a signal contact 84 with an upper section and a medial section 92, which passes through the lower wall of the a receptacle and a lower section 98 that extends "into the outer recess 22 for example, recess, where a solder ball 100 is fused to lower section." (See Houtz at Abstract; and Column 5, lines 20-35). As further shown in Figures 8 and 11, the solder ball is placed in an outer recess 24 of the receptacle where "the connector is subjected to a reflow process to fuse the solder balls onto the terminal tabs." In particular, the "medial area of the contact is positioned between the terminal tab and a contact area. The medial area is adapted to resist molten solder flow, for example, by application of a coating or plating of a non-solder wettable material. By this arrangement wicking of the solder from the solder ball from the area of attachment to the contact is avoided." (See Column 3, lines 4-14; and Column 7, lines 20-41).

Accordingly, this structure, including the medial area, primarily functions to reduce warping or twisting of the thermoplastic insulative housings of the connectors due to stresses generated when "soldering connectors to a substrate" not reduce cracking of the solder balls as taught in the Applicant's invention. (See Houtz at Abstract; and Column 2, lines 25-56).

In contrast, in Applicant's invention (e.g., as defined in Claim 1), the electronic terminal

for an electronic device includes a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. The "'electronic device' as used herein includes a single LSI chip such as called flip-chip, and a variety of types of semiconductor packages." (See Page 8, Lines 10-16). The support member is disposed on the electronic device, which functions to "prevent[ing] an excessive deformation of the lead member during an electrical test step of the electronic device, where[in] the solder ball is applied with a thrust force by a probe pin, by maintaining the location of the solder ball within a specified range." (See Page 7, lines 15-23).

Indeed, Houtz does not teach or disclose the above features of Applicant's invention. In particular, Houtz teaches a medial slot, i.e., a medial area, to "receive ground/power contacts or signal contacts" as part of the signal contact structure not an electronic device, let alone, a support member disposed on the electronic device as recited in Applicant's invention. Further, as indicated above, the medial support functions to resist molten solder flow not for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. (Column 5, lines 15-17). Houtz does not disclose any deformation of the medial area of the signal contact. Therefore, like the conventional art, the solder ball situated at the end of the signal contact may likely crack during a heat cycle test.

Please note, compared to Applicant's invention, Houtz teaches that the solder ball is in contact with the lateral walls even when no external force is applied and thus, the lateral walls are not separately disposed from the solder balls. Accordingly, the lateral walls entirely surround the lower section of the signal contact whereas in Applicant's invention the supporting member may be partially surrounded by the lead member by a combination of four insulation poles, as indicated above.

Houtz, therefore, does not teach, suggest or disclose including a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member.

For at least the reasons outlined above, Applicant respectfully submits that Houtz does not disclose, teach or suggest all the features of independent claim 1. Withdrawal of the rejection of claims 1, 2, 4, 5, 8-11, and 15-23 under 35 U.S.C. § 102(b) as anticipated by Houtz is respectfully requested.

B. The § 103(a) Rejection of Houtz in view of Beroz, et al.

First, the references, separately, or in combination, fail to teach, disclose or provide a reason or motivation for being combined.

Beroz, et al. ("Beroz") does not have the same aim as Houtz.

Beroz discloses a conventional micro-electronic assembly "incorporating soldered connections and [to] components incorporating pads for soldering," which includes a base having a non-solder wettable surface. (Column 3, lines 15-34). This configuration attempts to prevent solder flow in undesired locations and prevent displacement of solder from its desired location without the use of a solder mask "when processing an assembly" and thus "prevent solder from forming short circuits between adjacent pads, and may also act as a ground plane, power plane or shielding element." (See Beroz at Abstract; Column 1, lines 10-15 and 40-50; and Column 3, lines 15-55).

Nothing within Beroz which prevents undesired solder flow, suggests an electrical connector to reduce warping or twisting of a thermoplastic insulative housing of the connector due to stresses generated when "soldering connectors to a substrate" as disclosed in Houtz. Thus, Houtz teaches away from being combined with another invention, such as, Beroz.

Therefore, one of ordinary skill in the art would not have combined these references,

absent hindsight. It is clear that the Examiner has simply read Applicant's specification and conducted a keyword search to yield Houtz and Beroz. The Examiner provides no motivation or reason to combine other than to assert that it would have been obvious to one having ordinary skill in the art at the time to "use [an] external electrode that is out of contact with the support member of Beroz on the electrical terminal of Houtz in order to provide electrical isolation." (See Office Action at Page 8). Such an assertion does not take into account the distinct structural differences of the two inventions as indicated above, and further discussed below. Thus, the Examiner's conclusion attempts to solve a problem which may not exist with either Houtz or Beroz.

Second, even if combined, the references do not teach or suggest the features of independent claim 1, including a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member.

Beroz does not make up for the deficiencies of Houtz. Instead, Figures 1-6 of Beroz disclose a conventional micro-electronic assembly "incorporating soldered connections and [to] components incorporating pads for soldering." "A component according to this invention includes a base having a non-solder wettable surface... A plurality of pads which are wholly or partially solder-wettable are exposed to such surface of the base... a nonsolder-wettable electrically conductive potential plane element overlies the surface in proximity to the pads but spaced from the pads so that there is a gap between each pad and potential plane element." In addition, the molten solder is situated on an edge portion of a solder-wettable region and a pad. "When the assembly is bonded to a circuit board or other substrate, or engaged in a socket, the same solder bump may connect both the pad and the potential plane element to an external source of ground or power potential." This configuration prevents solder flow from undesired locations and prevent displacement of solder from its desired location without the use of a solder mask. (See Beroz at

Abstract; Column 1, lines 10-15 and 40-50; Column 3, lines 15-55; Column 6, lines 7-26; Column 8, lines 12-36; and Figures1, 2, 4 and 6).

In contrast, Applicant's invention discloses including a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. In particular, the support member is disposed on an electronic device to support the external electrode upon application of an external thrust force, whereas Beroz discloses an edge region of a solder-wettable region solder ball contacting traces, not an electronic device. Beroz teaches that this configuration assists with limiting solder flow, not to support an external electrode upon application of an external thrust force.

In addition, Applicant teaches that the external thrust force deforms the lead member whereas Beroz teaches a solder ball on a pad without any suggestion of a thrust force, let alone, an external thrust force which deforms the pad. Accordingly, Beroz does not disclose, teach or suggest any support member disposed on the electronic device, let alone, a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member.

Therefore, neither Houtz nor Beroz teaches or suggests including a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member as recited in claim 1.

For at least the reasons outlined above, Applicant respectfully submits that neither Houtz nor Beroz disclose, teach or suggest all of the features of the independent claim 1, and dependent claims 3, 6 and 7, are patentable not only by virtue of their dependency from the respective independent claim 1, but also by the additional limitations they recite.

For the reasons stated above, the claimed invention is fully patentable over the cited

references.

C. The § 103(a) Rejection of Houtz in view of Prior Art

Regarding claims 12-14, to make up for the deficiencies of Houtz discussed above, the Examiner relies on Applicant's Prior Art Figure 1D ("Prior Art"). The Prior Art fails to do so.

First, the Prior Art does not have the same aim as Houtz as discussed above, and the urged combination would not have been made, absent hindsight.

The Prior Art discloses a conventional flip-chip bonding structure where "a conductive spring or wire is used instead of the solder ball for achieving a higher density of the external terminals. The surface of the wire is coated with a thick plating for achieving a sufficient mechanical strength and resilience." (See Page 4, lines 4-8). Indeed, the Prior Art attempts to improve the flip-chip bonding structure, including the reliability of the connection, and reduce cracking of the solder ball during a heat cycle test. (See Page 2, lines 7-12; and 21-23).

Nothing within the Prior Art, which focuses on reducing cracking of the solder ball during a heat cycle test, has anything to do with an electrical connector to reduce warping or twisting of a thermoplastic insulative housing of the connector due to stresses generated when "soldering connectors to a substrate" as disclosed in Houtz. Thus, Houtz teaches away from being combined with another invention, such as, the Prior Art.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight.

Secondly, the Prior Art does not disclose, teach or suggest, a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member as recited in claim 1. (See Page 5, lines 9-17; Page 7, line 1-25; Page 10, line 1-11; and Figures 3-5).

Further, the Prior Art does not disclose, teach or suggest, including the lead member includes a conductor bump at least a portion of which is made of solder as recited in claim 14.

Instead, Prior Art discloses that the wire provides a mechanical strength and thus does not disclose, teach or suggest, including a support member, let alone, a support member disposed on the electronic device in the vicinity of the lead member for supporting the external electrode at least upon application of an external thrust force which deforms the lead member. Thus, the Prior Art is deficient and thus does not teach or suggest the limitations of dependent claims 12-14.

For the reasons stated above, the claimed invention, defined by dependent claims 12-14, is fully patentable over the cited references.

IV. FORMAL MATTERS AND CONCLUSION

In response to the objection raised to the drawings in the Office Action, Figures 3, 4, 5A and 5B have been amended to illustrate the proper cross-hatching for an electrically insulative material in accordance with the Specification. New Figures 3B and 3C have been added to show a "core,"a "solder coat,"and an "insulator sub-core" of claims 5-7, and the "through-hole" or "central hole" and "conductor" of claims 15, 16 and 20. In addition, a new Figure 6 has been added to show the electric terminal is part of an electronic instrument. The Specification has been amended to reflect the reference numerals assigned to these features. A Submission of Proposed Drawing Corrections is filed herewith.

Applicant traverses the additional objections under 37 CFR §1.83(a).

First, Figure 3 depicts a pad 16, which is an internal electrode. (See Specification, Page 7, lines 1-6). Second, Figure 4 depicts arrows, which are described as the stresses, or "external thrust force." (See Specification, Page 11, lines 1-15).

Third, Figure 4 depicts the supporting member, 14, "out of contact,"i.e., the gap, with the

external electrode. (See Specification, Page 10, lines 4-7). Fourth, claim 7 has been amended to indicate an "insulator sub-core" and depicted in new Figure 3B. (See Specification, Page 9, lines 23-24). Fifth, claims 9 and 10 have been amended to indicate that the lead member includes a conductor body. (See Specification, Page 8, line 23-Page 9, line 9).

Sixth, claims 12 and 13 have been amended to indicate that the lead member "is comprised of" a wire. (See Specification Page 7, lines 11-14). Seventh, claim 14 has been amended to indicate that the lead member includes a conductor bump. (See Specification, Page 9, lines 6-9). Eighth, claims 15, 20 and 21 have been amended and new Figure 3C depicts the "through-hole." (See Specification, Page 10, lines 12-16). Ninth, claim 17 has been amended to indicate that the supporting member includes a "resin body." (See Specification, Page 10, lines 12-16). Finally, claim 23 has been amended to indicate that the electric terminal is part of an electronic instrument or device.

The Examiner objects to minor spelling errors in the Specification. Applicant notes that these minor errors have been corrected.

In view of the foregoing, Applicant submits that claims 1-23 and 46-51, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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